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United States
Department of
Agriculture

Forest Service

Program Aid 1481



Every Species Counts:

Research on Threatened, Endangered, and Sensitive Plants and Animals



MAR 12 '93



Cover art by Charly Price

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February 1992

As manager of 191 million acres of national forests and grasslands, the Forest Service in the U.S. Department of Agriculture can and will do a great deal to halt the process of species extinction in the United States. By law and by inclination, the Forest Service and its employees are committed to leaving a richer legacy to future generations of Americans than the one we received. We believe that every threatened and endangered species counts. We are committed to saving them not only because they may provide benefits to future generations of human beings, but also because we have an ethical responsibility to save them.

Commitment and acceptance of responsibility are important components of a formula for saving threatened and endangered species. Research, however, is the ingredient that will turn these good intentions into successful actions. Land managers do not purposely degrade habitats and eliminate species. Species are lost when managers do not know what the species require for existence. Species are lost when managers cannot predict how an ecosystem will respond to disturbance or change. A Forest Service research program is providing information on the basic biology of endangered species. It is helping managers to anticipate the needs of the species. It is providing the necessary technology and it is helping to develop strategies that will ensure the survival of threatened and endangered species.

This brochure describes the Forest Service research program for threatened, endangered, and sensitive (TES) species. It also shows how the research fits into the agency's overall program for these species.



*Western prairie
fringed orchid*

BILL AND SUE BLUNT

Getting it into Perspective

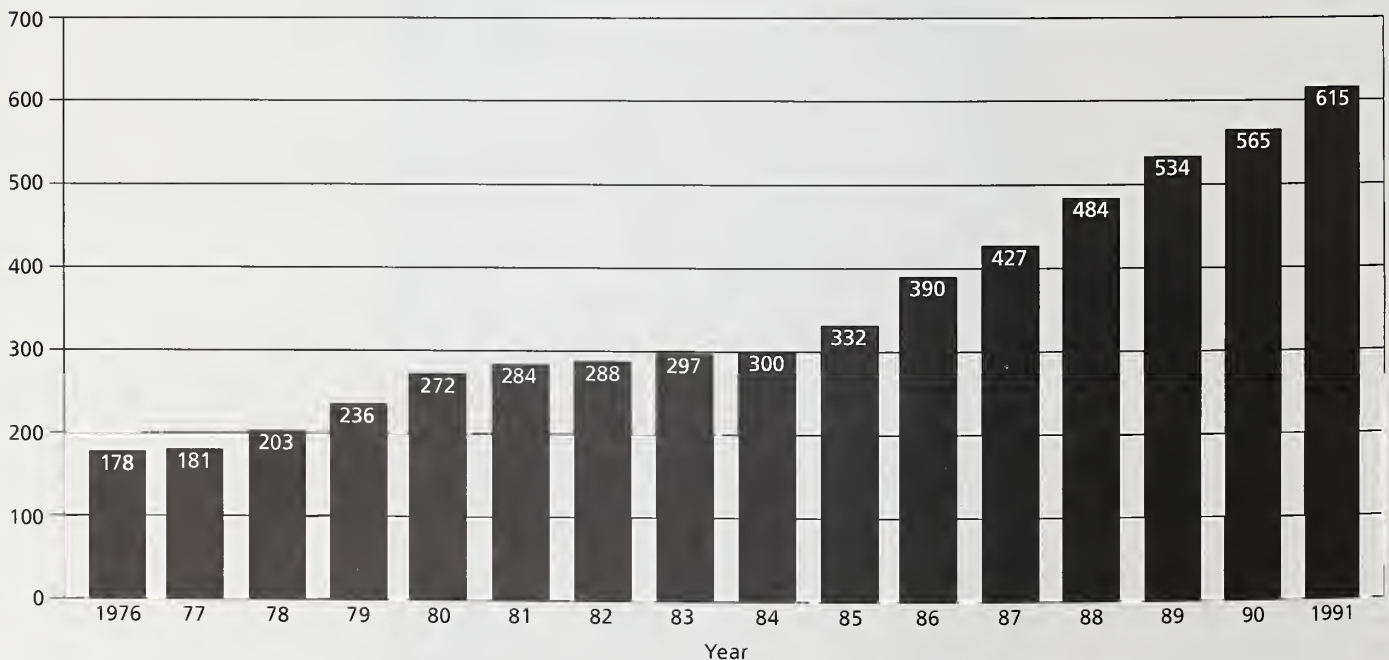
Extinction is part of the natural evolutionary process that has been occurring on our planet since life began here billions of years ago. As a result, most of the species that once existed on Earth became extinct before humans even arrived. Human beings, however, have accelerated the process of species extinction at an alarming rate. In 1976, the number of species of plants and animals listed as threatened or endangered by the Federal Government was 178. Since then, that estimate has increased steadily (figure 1), reaching 615 by January 1991. The large and steady increase reflects an improved knowledge of what species are present and how they are faring, but it also shows that preventing species extinction is a huge and growing task.

About one-third of the species on the Federal list occur on national forests and grasslands. Each year, 15 to 20 species of plants and animals that inhabit these public lands are added to the list of threatened and endangered species. We have a special responsibility here, and we will honor it.

Federal laws and regulations direct the Forest Service to conserve the plants and animals that inhabit our national forests and grasslands. The Endangered Species Act of 1973 prohibits Federal agencies from jeopardizing endangered species or their habitats by land management activities. The National Forest Management Act of 1976 directs the Forest Service to maintain viable populations of all native and some nonnative vertebrates. Agency regulations extend this mandate to include plants and invertebrates.

Figure 1—Trends in Number of Threatened and Endangered Species in the United States

Total U.S.
Species Listed



Through its internal regulations, the Forest Service added the category "sensitive" to identify plant and animal species that are not yet threatened with extinction but that have the potential to be threatened or endangered. We have identified 2,280 sensitive species. There is concern for the long-term viability of these species even though they are not in immediate danger of extinction.

The national forests and grasslands are sometimes the last refuge for species on the brink of extinction. Because of our agency's critical role in saving these species, the Chief of the Forest Service developed an action plan for their recovery and conservation. That plan, called "Every Species Counts," outlines approaches the Forest Service will take between now and the year 2000 to ensure the recovery of threatened, endangered, and sensitive species. It is an ambitious plan that depends heavily upon research for its success.

TES Program Goal

The Forest Service is dedicated to recovering and maintaining threatened, endangered, and sensitive species to ensure the biodiversity of U.S. forests and rangelands. The goal of the TES program is to protect threatened and endangered species from extinction and to prevent sensitive species from becoming threatened or endangered, by anticipating the needs of TES species, and by managing their habitats for their protection and recovery.

*Little Colorado
River spinedace*



TES Research Objectives

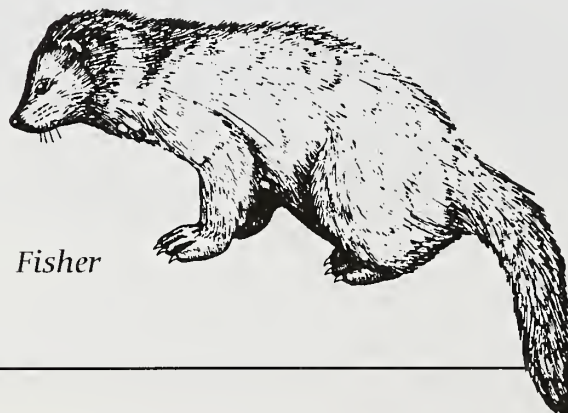
Research plays a critical and supportive role in the Forest Service's efforts in management and recovery of TES species on their lands. Species are lost when we lack the basic understanding of what an organism requires for its existence or when we lack the capability to predict how a particular ecosystem will respond to a perturbation or change. The role of research is to acquire both the knowledge of what TES species require to persist and the ability to predict how TES species will respond to habitat manipulation.

The TES Research Program has established these objectives:

- Accelerate and expand research programs encompassing individual species requirements, the process of extinction, and population viability assessments.
- Provide management strategies that will anticipate problems and forestall population declines.
- Implement technology transfer strategies for conveying research findings to managers and cooperators.
- Foster partnerships to coordinate management, recovery, and consultation among Forest Service land managers, Forest Service biologists, the Fish and Wildlife Service, and the National Marine Fisheries Service.

Should the Forest Service TES Research Program succeed in meeting its objectives, species will be saved and the Forest Service will gain additional dividends:

- A strong, scientific foundation for management will place the Forest Service in the forefront of threatened and endangered species recovery. The Forest Service will be able to offer a sound, scientific basis for TES management activities, establishing credibility as an authority on TES species and management of their habitats.
- More comprehensive information will be provided to Forest Service administrators, thus ensuring that requirements of TES species are fully considered in the land management planning process, which in turn can reduce the number of appeals related to these plans.
- Full support of the Endangered Species Act and the National Forest Management Act regulations will decrease costly and divisive litigation in the courts.



Fisher

Brief History of TES Research

Shortly after passage of the Endangered Species Act, the Forest Service began a research program on threatened and endangered species in our Nation's forests and rangelands. In the first few years of this effort, funding for this program was approximately \$800,000 per year. By 1975, researchers at 7 locations around the country were conducting studies on 14 species. Over the next 15 years, both the number of species being studied and the funding for those studies gradually increased in the TES Research Program. In 1987, Congress doubled the investment in TES research by adding \$1.5 million to the Forest Service Research budget to initiate a major research effort on the spotted owl. Since 1987, TES funding has increased to \$5.3 million in FY 1990 and to \$7 million in FY 1991. There are over 75 species currently being studied under the Forest Service's TES Research Program (table 1).

*Puerto Rican
parrot*



USDA FOREST SERVICE

Current Status of TES Research

The TES Research Program is directing its efforts toward understanding species' requirements for persistence, translating these requirements into guidelines, and developing strategies for integrating TES conservation with other resource management activities. Although funding for TES research has increased steadily, to an all-time high of just over \$7 million in FY 1991, more than two-thirds of the total TES budget is spent on only four species: spotted owl, red-cockaded woodpecker, Puerto Rican parrot, and grizzly bear. Over half of the total has been invested in spotted owl research alone. That leaves just one-third of the total funding for 70 TES species currently being studied, and none at all for more than 2,400 other TES species (figure 2).

There are now 22 Forest Service research projects nationwide involved in TES research, studying over 75 plant and animal species (figure 3, table 1). In 1991, this TES research program expanded its scope to include TES plants and aquatic species. Of the 201 species currently identified as threatened and endangered on Forest Service lands, 66 are plants and 68 are aquatic animals. Of the 2,280 sensitive species on these public lands, 1,654 are plants and 224 are aquatic animals.

If so much work needs to be done, why so small a percentage of the budget for so many species? This is a result of:

- Limited funding.
- High visibility of a few controversial TES species that take up most of the funding.
- A limited number of research scientists to work on TES species.

*Pine
marten*



STEPHEN E. HENRY

Figure 2—Breakout of TES Research Funding

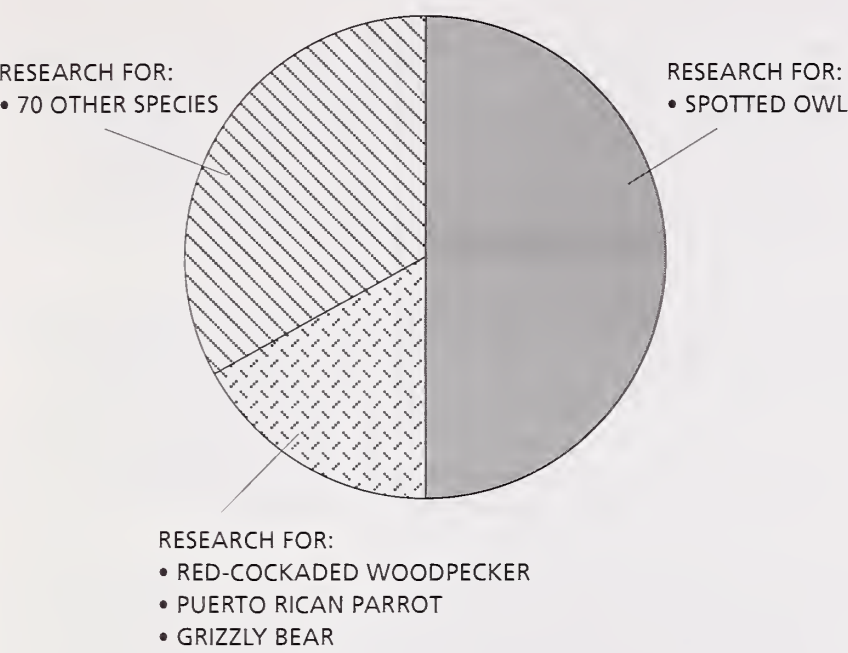
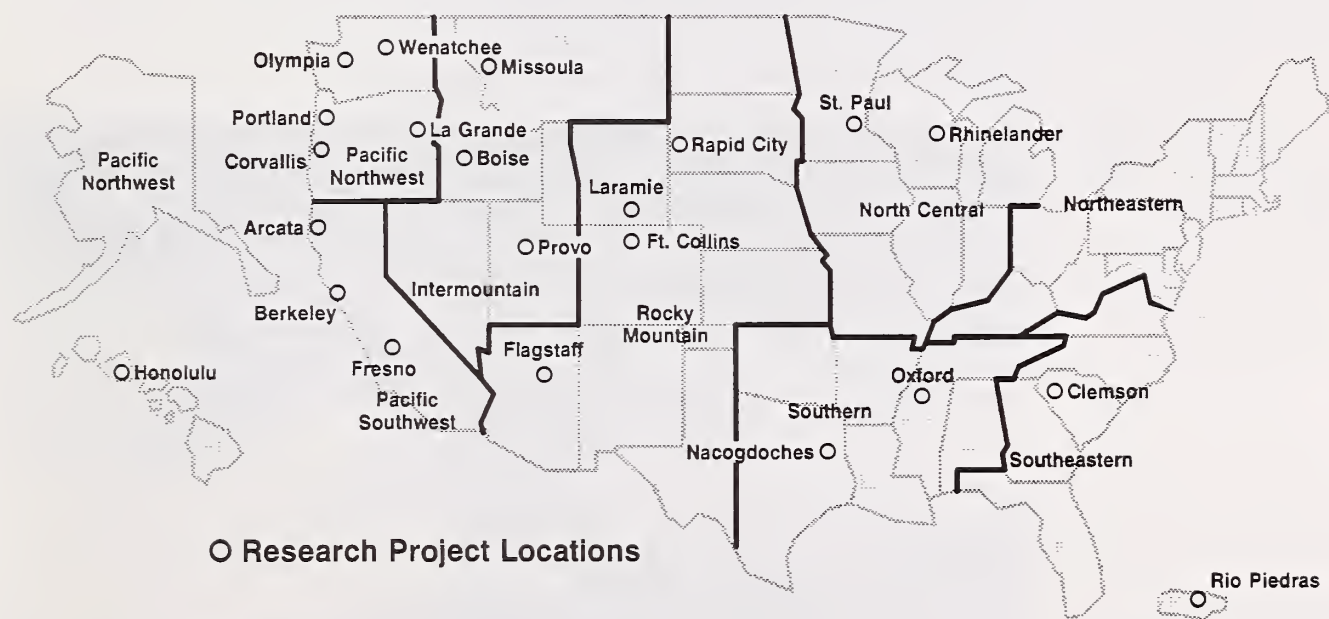


Figure 3—Forest Service Research on Threatened, Endangered, and Sensitive Species



Benefits

The TES Research Program has been successful and has made progress in a significant number of areas:

- In Puerto Rico, joint efforts between the Forest Service and the Fish and Wildlife Service identified the major factors that limited the recovery of the Puerto Rican parrot. Applying research findings led to a dramatic increase in population from 14 birds in 1972 to 47 birds just before Hurricane Hugo hit in 1989. Since the hurricane, we have found an estimated 30 parrots, but the number of breeding pairs is at an all-time high of 6.
- In the Southwest, recovery efforts on behalf of the endangered Gila trout and threatened Apache trout include the reintroduction of these species into streams in their historic range. Forest Service researchers have worked with biologists from other agencies to locate suitable sites for reintroduction and to provide techniques for preparing these sites for the new fish. Expanding the distribution of these species will lessen the impact of any localized catastrophes on the entire species.
- In the Southeast, research and management efforts have resulted in the first recorded population increase for the endangered red-cockaded woodpecker. Also, silvicultural options have been developed to improve the bird's habitat while maintaining a timber harvest in surrounding forests. After the devastation of Hurricane Hugo in 1989, biologists on the Francis Marion National Forest used technology developed by researchers from the Southeastern Forest Experiment Station and North Carolina State University to replace lost cavity trees with artificial cavities. In 1991, 55 percent of the nests on the Francis Marion National Forest were in these artificial cavities.

*Grizzly
bear*



USDI NATIONAL PARK SERVICE

- Spotted owl research has been ongoing since 1987 in Washington, Oregon, and California. Results from Forest Service studies have provided needed information to both the Interagency Scientific Committee to Address Conservation of the Northern Spotted Owl and the Northern Spotted Owl Recovery Team. Based on this information, these two groups have formulated recommendations for habitat management and for protecting and sustaining a viable population of spotted owls throughout its range.
- Forest Service researchers in the northern Rockies have developed a comprehensive research program to encourage grizzly bear survival and recovery. Studies on grizzly bear habitat selection and use have provided valuable information for land managers on the kind of vegetation and size of area needed for grizzly bear critical habitats. Current studies by Forest Service researchers on nutrition, physiology, and bear behavior will provide necessary information to continue to improve these critical habitats.
- Research on wildlife species found in old-growth Douglas-fir and Douglas-fir/mixed evergreen forests of the Pacific Northwest and northern California has shown that several species are strongly associated with old growth: examples include at least one bat, two other small mammals, four birds, and five amphibians. A recent book, *Wildlife and Vegetation of Unmanaged Douglas-Fir Forests*, written by Forest Service researchers, provides management recommendations for meeting the special habitat needs of these species.
- Forest Service researchers are cooperating with biologists from State and Federal agencies to develop a recovery plan for the western prairie fringed orchid population in eastern North Dakota. The Fish and Wildlife Service recently listed this species as threatened. Current Forest Service research efforts focus on assessing the impact on orchid populations of management practices such as grazing, mowing, and burning.
- For over 15 years, Forest Service researchers have been studying the Kirtland's warbler and its habitats in central Michigan, in cooperation with other Federal and State agencies. The result is a 63-percent increase in the Kirtland's warbler population in recent years. But much of this increase may be due the development of suitable habitat that resulted from a fire in 1980. Current joint research is examining the success of plantation habitats created for the warbler and how the distribution of these habitat patches across the landscape affects their use by these endangered songbirds.
- In 1989, a group of more than 50 State and Federal land management agencies, universities, and private organizations across the United States and Canada joined to form the Rare Plant Consortium. This Consortium, headquartered in Wenatchee, Washington, was created to promote and facilitate the conduct of both basic and applied research on rare plants. Through research and monitoring, Consortium members are developing a better understanding of rarity in plants and are providing recommendations for the preservation of rare plants and their associated ecosystems. The Consortium also provides a forum where land managers can raise issues related to rare plants and find information to assist them in making management decisions.

Future TES Research

The primary focus of the TES Research Program will be on the recovery of threatened and endangered species and on those environmental pressures that contribute to their peril. In addition, researchers will be studying groups of species, such as old-growth wildlife and riparian wildlife, that live in vulnerable ecosystems. We will also examine the general processes by which species become extinct. Through the TES Research Program, we will continue to refine those parameters that define a species as sensitive and investigate the causes that have begun to impact their viability. The TES Research Program will be:

- *Broadbased.* TES Research will become even more diversified in its study of birds, mammals, fish, mussels, reptiles, amphibians, and plants (table 2).
- *Timely.* TES Research will establish timely transfer of technological advancements so that field managers can implement them.
- *Cooperative.* TES Research will continue to encourage close cooperation among Federal, State, local, and private agencies to improve management and recovery of TES species.

The TES Research Program has identified four major research approaches that will serve as guidelines for conducting the kind of research that will lead to the recovery of TES species.

1. Identify resource requirements and life history patterns of TES species.

Under this approach, the research team will:

- Identify habitat and site selection (food, nutrients, shelter, and breeding sites).
- Identify processes and patterns of habitat/site use (behavioral and/or physiological adaptations).
- Determine preferred habitats/sites by relating use to availability.
- Identify factors (resources, competition, predation, disease, genetics, and so forth) that influence reproduction, growth, and survival.
- Identify sex, age, and genetic structure within populations.
- Identify dispersal patterns and interactions among populations.

2. Determine the response of organisms, populations, or selected groups of TES species to habitat/site manipulation and changing environments.

Under this approach, the research team will:

- Determine plant and animal responses to habitat or site disturbance related to resource development activities.



Bald eagle

- Determine how plants and animals respond to human-related disturbance or stress, such as noise, air pollution, environmental toxins.
- Determine how populations and communities change with natural succession and following natural disturbance (hurricanes, droughts, fires, and so forth).
- Determine how historical land changes (natural and human-induced) have influenced the distribution and abundance of TES species.
- Determine how silviculture and other vegetation management practices can improve habitat/site quality.

3. Determine factors regulating population growth and stability and develop population viability assessments.

Under this approach, the research team will:

- Determine variation in sex, age, and genetic structure among populations.
- Relate life history characteristics and genetic structure to population growth rate.
- Determine how spatial and temporal distribution of habitats influence population stability and species persistence.
- Model the probability of population or species persistence in relation to genetic, environmental, and demographic variation.
- Model the probability of species persistence in relation to the spatial distribution of populations, rates of movements among populations, and rates of local extinctions and colonizations.

4. Develop recovery and monitoring technologies.

Under this approach, the research team will:

- Synthesize knowledge of resource requirements and life history into habitat management guidelines.
- Develop strategies for using silviculture and other vegetation management practices to improve habitat/site quality.
- Develop guidelines for distributing habitats with respect to area and time.
- Develop techniques for monitoring habitat and population trends.
- Develop techniques for monitoring genetic variation and relating genetic parameters to population growth and stability.
- Develop techniques for translocating individuals and reestablishing populations.

Summary

Each year, about 15 to 20 species of plants and animals found on our national forests and grasslands are being added to the list of threatened and endangered species. With an ever-increasing number of species in peril, the Forest Service must play a leading role in the protection and management of threatened and endangered species, and go a step further to protect more species at risk, sensitive species, before they begin their approach to extinction.

To meet this challenge, in April 1990 the Chief of the Forest Service released his action plan for "Threatened, Endangered, and Sensitive Species Recovery and Conservation." Forest Service Research has outlined an expanded research program on threatened, endangered, and sensitive (TES) species to help the agency meet its goal of recovery and conservation of TES plant and animal species.

The TES Research Program will be expanded over the next 10 years to include a wider variety of plants and animals. The Forest Service will also study the process of extinction and develop population viability assessments. This research will provide management strategies enabling managers to anticipate problems and forestall population declines. We will convey this new information and technology to land managers and cooperators in a timely fashion and will work with other Federal, State, and local agencies to provide for the management and recovery of these species.

*Red-cockaded
woodpecker*



R. TODD ENGSTROM

Table 1 – Species in Current TES Research Program by Research Station

<i>Research Location</i>	<i>Species Under Study</i>	<i>Focus of Research</i>
Pacific Northwest		
LaGrande, Oregon	Pileated woodpeckers, Vaux's swift, pine marten	Forest fragmentation, loss of old-growth habitats, monitoring techniques
Corvallis, Oregon	Spring chinook salmon, steelhead trout	Habitat restoration
Olympia, Washington	Northern spotted owl and its major prey species, pine marten, pileated woodpeckers	Demographic parameters, ecology, forest fragmentation
Portland, Oregon	Spotted owl	Geographic differences among subspecies' habitats
Wenatchee, Washington	Spotted owl, pine marten, fisher	Demographic parameters, home range and habitat characteristics, silvicultural techniques, effects of timber harvest
	Wenatchee larkspur, showy stickseed, Chelan rockmat, Thompson's clover, Henderson's ricegrass	Status of these TES plant species
Pacific Southwest		
Berkeley, California	Ten California cypresses, Port-Orford-cedar, Santa Lucia fir, big cone Douglas-fir, Brewer spruce, <i>Carpenteria californica</i> , coho salmon, ten species of <i>Ceanothus</i>	Genetic structure, genetic endangerment, population viability
Fresno, California	California spotted owl	Habitat requirements, effects of logging
	Bolander's clover, longhair mariposa lily	Effects of grazing
Arcata, California	Northern spotted owl, pine marten, marbled murrelet, Del Norte salamander, Olympic salamander, tailed frog	Demographic parameters, habitats and ecology, viability assessments
Honolulu, Hawaii	Hawaii akepa, akiapolauu, 'o'u, Hawaii creeper	Forest habitat characteristics, habitat restoration technology

Table 1 – Species in Current TES Research Program by Research Station (continued)

<i>Research Location</i>	<i>Species Under Study</i>	<i>Focus of Research</i>
Intermountain		
Missoula, Montana	Grizzly bear	Habitat characteristics, major food plant productivity, habitat management
Provo, Utah	Zion tansy, <i>Penstemon</i> species	Ecology, genetic variation
Boise, Idaho	Yellowstone cutthroat trout, bull trout, chinook salmon, Paiute cutthroat trout	Habitat characteristics, monitoring techniques, effects of changes in substrate on fish populations
Rocky Mountain		
Laramie, Wyoming	Pine marten, greenback cutthroat trout, Colorado River cutthroat trout	Habitats, population dynamics
Flagstaff, Arizona	Apache trout, Little Colorado River spinedace, spikedace, Gila chub, loach minnow, Sonoran chub, bald eagle, Mexican spotted owl	Habitat requirements, effects of timber harvest and grazing, demographic parameters
	Arizona willow, Gooding's onion, northern goshawk, flammulated owl	Effects of land management activities
Rapid City, South Dakota	Western prairie fringed orchid	Effects of land management activities
Fort Collins, Colorado	Threatened and endangered species	Map nationwide distribution, identify high-density areas
North Central		
Rhineland, Wisconsin	Kirtland's warbler	Reproduction, nesting habitats
St. Paul, Minnesota	Gray wolf, boreal owl, bald eagle, Kirtland's warbler	Ecology, habitats

Table 1 – Species in Current TES Research Program by Research Station (continued)

<i>Research Location</i>	<i>Species Under Study</i>	<i>Focus of Research</i>
Southeastern		
Clemson, South Carolina	Red-cockaded woodpecker	Nest predation, cavity competition, population viability, habitat quality, impact of Hurricane Hugo
	Plants in longleaf pine ecosystem	Ecology, effects of land management activities
Southern		
Rio Piedras, Puerto Rico	Puerto Rican parrot	Phenology of major food plants, cavity competition, reproductive success, impact of Hurricane Hugo
Nacogdoches, Texas	Red-cockaded woodpecker	Foraging habitat, impacts of pine beetle and forest management on habitat

*Northern
spotted owl*



KEN BEVIS

Table 2 – Priority Species for Future TES Research Program by Research Station

<i>Research Location</i>	<i>Priority Species</i>
<hr/> Pacific Northwest	
Alaska	Pine marten
Copper River Delta, AK	Gray wolf, dusky Canada goose, trumpeter swan
Washington	Pine marten, northern spotted owl, Columbia River basin salmon stocks
Washington Cascades	Fisher, gray wolf
Olympic Peninsula, WA	Fisher
Western Washington	Pileated woodpecker, marbled murrelet, pygmy owl, northern goshawk, Van Dyke's salamander
Eastern Washington	North American lynx, black-backed and three-toed woodpeckers, northern goshawk, Wenatchee larkspur, Chelan rockmat, showy sticksee, Thompson's clover
Oregon	Pine marten, northern spotted owl, Columbia River basin salmon stocks
Western Oregon	Red tree vole, Vaux's swift, pygmy owl
Central Oregon	White-headed woodpecker
Eastern Oregon	Vaux's swift, northern goshawk, spotted and tailed frogs
Oregon Coast Range	Olympic salamander, tailed frog
<hr/> Pacific Southwest	
California	California red-legged frog, TES Cypress species, Port-Orford-cedar, <i>Calochortus</i> lilies, <i>Pinus maximartinezii</i> , California oaks, Santa Lucia fir, <i>Carpenteria californica</i> , <i>Ceanothus</i> species
Northern California	Pine marten, fisher, wolverine, Del Norte salamander, tailed frog, Olympic salamander, coho salmon, summer steelhead trout
Central California	Pine marten, fisher, wolverine, California spotted owl, willow flycatcher
Southern California	California spotted owl
Hawaii	Hawaiian hoary bat, akepa, akiapolaau, 'o'u, palila, <i>Vicia menziesii</i>
Mariana Islands and Guam	Little Mariana fruit bat, Guam kingfisher, Micronesian megapode, Tinian monarch, nightingale reed warbler

Table 2 – Priority Species for Future TES Research Program by Research Station (continued)

<i>Research Location</i>	<i>Priority Species</i>
Intermountain	
Northern Rocky Mountains	Grizzly bear, northern Rocky Mountain wolf, wolverine, flammulated owl, boreal owl, black-backed woodpecker
Idaho	Chinook salmon, bull trout, sockeye salmon, steelhead trout, westslope cutthroat trout, rainbow trout, white sturgeon, burbot, <i>Penstemon</i> species, <i>Castilleja</i> species, Buxbaum's sedge
Northern Idaho	Woodland caribou, harlequin duck, Buxbaum's sedge, yellow sedge, creeping snowberry, northern bog clubmoss, western starflower, swamp cranberry, Pacific dogwood, candystick, broad-fruit mariposa, Spalding's catchfly
Central and Southwestern Idaho	Preble shrew, three-toed woodpecker, MacFarlane's four-o'clock, giant helleborine, Aase's onion, Goose Creek milkvetch, Christ's paintbrush
Eastern Idaho	Bald eagle, American peregrine falcon, common loon, trumpeter swan, great gray owl, Yellowstone cutthroat trout, Bonneville cutthroat trout, Alkali primrose, yellow spring-beauty
Montana	Fluvial grayling, bull trout, westslope cutthroat trout, rainbow trout, burbot
Western Wyoming	Yellowstone cutthroat trout, Bonneville cutthroat trout, <i>Castilleja</i> species
Utah	Desert tortoise, Zion tansy, <i>Penstemon</i> species, <i>Castilleja</i> species, heliotrope milkvetch, Rydberg milkvetch, spineless hedgehog cactus, Fish Lake naiad, Maguire primrose, Last Chance townsendia, several milkvetch species, Untermann daisy, Widtsoe buckwheat, Canyon sweetvetch, <i>Hymenoxys</i> species, Lyall's phacelia, Uinta green thread
Nevada	Lahontan cutthroat trout, bull trout, <i>Penstemon</i> , <i>Castilleja</i> species, <i>Astragalus remotus</i> , Nevada willow-herb, Dog Valley ivesia, <i>Primula</i> species, Tahoe yellowcress, Charleston kittentails, wavy-leaf thelypody

Table 2 – Priority Species for Future TES Research Program by Research Station (continued)

<i>Research Location</i>	<i>Priority Species</i>
Rocky Mountain	
North Dakota	Swift fox, loggerhead shrike, upland sandpiper, long-billed curlew, mountain plover, western prairie fringed orchid
South Dakota	Black-footed ferret, swift fox, loggerhead shrike, upland sandpiper, long-billed curlew, mountain plover
Nebraska	Swift fox
Wyoming	Pine marten, southwestern river otter, North American lynx, wolverine, northern goshawk, boreal owl, three-toed woodpecker, black-backed woodpecker, loggerhead shrike, upland sandpiper, long-billed curlew, mountain plover, Colorado River cutthroat trout, greenback cutthroat trout
Colorado	Pine marten, swift fox, southwestern river otter, North American lynx, wolverine, Mexican spotted owl, northern goshawk, boreal owl, three-toed woodpecker, black-backed woodpecker, flammulated owl, loggerhead shrike, upland sandpiper, long-billed curlew, mountain plover, Colorado River cutthroat trout
New Mexico	New Mexican jumping mouse, Arizona shrew, Mexican spotted owl, northern goshawk, flammulated owl, Sacramento Mountain salamander, Jemez Mountain salamander, spinedace, loach minnow
Arizona	Pine marten, Preble's meadow jumping mouse, Arizona shrew, northern water shrew, Mexican vole, Mt. Graham red squirrel, red bat, southern yellow bat, spotted bat, southwestern river otter, Mexican spotted owl, northern goshawk, bald eagle, flammulated owl, gray catbird, veery, American redstart, cactus ferruginous pygmy owl, osprey, western yellow-billed cuckoo, narrowheaded garter snake, Mexican garter snake, Arizona skink, desert tortoise, massasauga, Arizona ridge-nosed rattlesnake, green rat snake, Huachuca tiger salamander, Chiricahua leopard frog, plains leopard frog, Tarahumara frog, barking frog, northern casque-headed frog, Little Colorado River spinedace, Apache trout, spinedace, loach minnow, Gila chub, Sonoran chub, Arizona willow, Gooding's onion, groundsel, Mogollon Indian-paintbrush, dock (<i>Rumex orthoneurus</i>)

Steelhead trout



Table 2 – Priority Species for Future TES Research Program by Research Station (continued)

<i>Research Location</i>	<i>Priority Species</i>
North Central	
Upper Great Lake States	Keen's myotis, eastern cougar, piping plover, wood turtle, lake sturgeon
Minnesota	Gray wolf, bald eagle, American peregrine falcon, migrant loggerhead shrike, Goblin fern
Wisconsin	Gray wolf, North American lynx, bald eagle, migrant loggerhead shrike, greater redhorse, Karner blue butterfly, Fassett's locoweed, Goblin fern
Michigan	North American lynx, Kirtland's warbler, greater redhorse, Karner blue butterfly, American hart's-tongue fern, Michigan monkey-flower, Houghton's goldenrod
Illinois	Mead's milkweed, French's shootingstar
Indiana	Indiana bat, Karner blue butterfly, French's shootingstar
Missouri	Indiana bat, Bachman's sparrow, southern cavefish, Salem cave crayfish, Mead's milkweed, French's shootingstar
Northeastern	
New England States	Long-tailed shrew, Keen's myotis, New England cottontail, northern bog lemming, North American lynx, migrant loggerhead shrike
Southeastern	
Southeastern States	Red-cockaded woodpecker, several benthic fish species, several mussel species, plants in longleaf-wire grass ecosystem
Virginia	Virginia northern flying squirrel
North Carolina	Carolina northern flying squirrel
South Carolina	Red-cockaded woodpecker
Florida	Sherman's fox squirrel

Table 2 – Priority Species for Future TES Research Program by Research Station (continued)

<i>Research Location</i>	<i>Priority Species</i>
Southern	
Arkansas	Indiana bat, leopard darter, Arkansas darter, yellowcheek darter, paleback darter, longnose darter, stargazing darter, Arkansas River shiner, Ouachita Mountain shiner, peppered shiner, Ouachita madtom, Caddo madtom, Lefevre's pearly mussel, Arkansas fat mucket (mussel), speckled pocketbook (mussel), Neosho mucket (mussel), pondberry
Mississippi	Louisiana black bear, Indiana bat, bayou darter, Yazoo darter, freckled darter, several shiner species, frecklebelly madtom, penitent mussel, pondberry
Louisiana	Louisiana black bear, Indiana bat, freckled darter, stargazing darter, several shiner species, frecklebelly madtom, Louisiana pearlshell (mussel), pondberry
Tennessee	Indiana bat
Texas	Louisiana black bear, red-cockaded woodpecker, Bachman's sparrow, Gould's wild turkey, Louisiana pine snake, timber rattlesnake, slender gay-feather, erect milkpea, sawtooth nerveray, bog coneflower, rose pogonia, rough-leaf yellow-eyed grass
Puerto Rico	Puerto Rican parrot, elfin woods warbler, Puerto Rican boa, Puerto Rican crested toad, <i>Eleuthrodatylus eneidae</i> (a terrestrial frog)

*Townsend's
big-eared bat*



